REMARKS:

Claims **12-22, 25, 26,** and **28-38** were examined. No new subject matter has been introduced.

INTERVIEW SUMMARY

Applicants thank the Examiner for the courteous interview of 20 February 2009 granted to Brian M. Sager and Hao Y. Tung. Applicants discussed the claim language, cited references, and established the expertise of Professor McGehee's in the area of self-assembly. A copy of Professor McGehee's technical qualification were provided to the Examiner during the interview and a copy is included with the response for the official record. During the interview, the Examiner indicated that a further affidavit from another third party would be persuasive in regards to the unexpected result of the claimed invention. No agreement was reached.

CLAIM REJECTIONS

35 USC 103

CLAIM 12 IS ALLOWABLE OVER BRINKER AND DAM

Claims **12-17**, **19-26**, and **28-38** were rejected under 35 USC 103(a) as being obvious over U.S. Patent 6,264,741 to Brinker et al. (hereinafter "Brinker") in view of European Patent No. 1225188 to Dams (hereinafter "Dams") and US 6,866,901 to Burrows et al. (hereinafter "Burrows"). The Applicant respectfully traverses the rejection.

Per the Examiner's request during the Examiner Interview, in addition to the previously submitted McGehee affidavit under 37 CFR 1.132, Applicants further present the declaration of Professor David Chandler of the University of California at Berkeley regarding the non-obviousnesss of combining the cited Brinker and Dams reference to arrive at the presently claimed invention. Professor Chandler is the Bruce Mahan Professor of Chemistry at the University of California at Berkeley and his principal research has been devoted to understanding liquids, per his biography at http://gold.cchem.berkeley.edu/chandler.html. His curriculum vitae is attached. Additionally and more to the point, Professor Chandler is the lead author of the previously cited paper of record on micelle formation and self assembly entitled "Micelle Formation and Hydrophobic Effect" published in J. Phys. Chem. B 2004, 108, 6778-6781. As such, Applicants respectfully submit that Professor Chandler has expertise in the area of micelle formation and self-assembly processes. Per the combined affidavits of McGehee and

Chandler, Applicants respectfully submits the obviousness to combine the Brinker reference with the Dams reference has been traversed. Per MPEP 716.02(a) evidence of greater than expected results are evidence of non-obviousness. As Burrows does not rectify the deficiencies of Brinker, Applicant respectfully request that the rejection to claim **12** and its dependent claims be withdrawn. Claims **36-38** are believed to be allowable for substantially the same reasons set forth above.

CONCLUSION

For the reasons set forth above, the Applicant submits that all claims are allowable over the cited art and define an invention suitable for patent protection. The Applicant therefore respectfully requests that the Examiner enter the amendment, reconsider the application, and issue a Notice of Allowance in the next Office Action.

Respectfully submitted,

/Hao Y. Tung/

Hao Y. Tung, Reg. No. 43,209 Date: October 30, 2009

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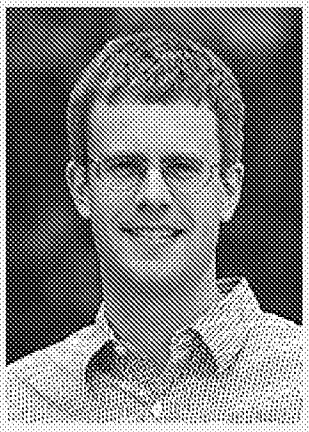

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Degrees

Degree	Year	School
PhD	1999	UC Santa Barbara
BA	1994	Princeton

Academic Honors & Awards

Vance D. & Arlene C. Coffman Faculty Scholar(2007)
Mohr Davidow Innovators Award (2007)
MRS Outstanding Young Investigator Award (2007)
Gilbreth Lecturer at the National Academy of Engineering's National Meeting (2006)
Dupont Young Professor Award (2001)
National Science Foundation CAREER Award (2001)
Henry and Camille Dreyfus New Faculty Award (2000)
Materials Research Society Graduate Student Gold Medal Award (1999)
Corning Foundation Fellowship (1998)

RESEARCH STATEMENT

McGehee's research group studies organic semiconductors, nanostructures and solar cells.

Dr. Michael D. McGehee, co-Principal Investigator of the Center for Advanced Molecular Photovoltiacs (CAMP), is an associate professor in the Materials Science and Engineering Department at Stanford University. His research interests are patterning materials at the nanometer length scale, semiconducting polymers, and solar cells.

He received his undergraduate degree in physics from Princeton University and his Ph.D. degree in materials science from the University of California at Santa Barbara, where he did research on polymer lasers in the lab of Nobel Laureate Alan Heeger.

He has won an NSF CAREER Award, a Dupont Young Professor Award, a Henry and Camille Dreyfus New Faculty Award, the 2007 Materials Research Society Outstanding Young Investigator Award, and the Mohr Davidow Innovators Award.

Photovoltaic cells

Exciton harvesting, charge transfer, and charge-carrier transport in amorphous-silicon nanopillar/polymer hybrid solar cells, V. Gowrishankar, S.R. Scully, A.T. Chan, M.D. McGehee, Q. Wang, H.M. Branz, Journal of Applied Physics, 103 (2008) 064511.

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Organic Solar Cells with Carbon Nanotube Network Electrodes, M.W. Rowell, M.A. Topinka, M.D. McGehee, H.J. Prall, G. Dennler, N.S. Sariciftci, L. Hu, G. Gruner, Applied Physics Letters, 88 (2006), 233506.

Effects of Optical Interference and Energy Transfer on Exciton Diffusion Length Measurements in Organic Semiconductors, S.R. Scully and M.D. McGehee, Journal of Applied Physics, 100 (2006), 034907.

Fabrication of Densely Packed, Well-Ordered, High-Aspect-Ratio Silicon Nanopillars Over Large Areas Using Block Copolymer Lithography V. Gowrishankar, N. Miller, M.D. McGehee, M.J. Misner, D.Y. Ryu, T.P. Russell, E. Drockenmuller, C.J. Hawker, Thin Solid Films 513 (2006), 289.

Resonance Energy Transfer from Organic Chromophores to Fullerene Molecules, Y. Liu, M.A. Summers, S.R. Scully, M.D. McGehee, Journal of Applied Physics 99 (2006), 093521.

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Infiltrating Semiconducting Polymers into Self-Assembled Mesoporous Titania Films for Photovoltaic Applications, K.M. Coakley, Y. Liu, M.D. McGehee, K. Frindell, G.D. Stucky Advanced Functional Materials, 13 (2003) 301.

Charge transport in organic semiconductors

Morphology and Charge Transport in Conjugated Polymer (Review Article), R.J. Kline, M.D. McGehee, Journal of Macromolecular Science - Polymer Reviews 46 (2006) 27.

Liquid-Crystalline Semiconducting Polymers with High Charge Carrier Mobility, I. McCulloch, M. Heeney, C. Bailey, K. Genevicius, I. MacDonald, M. Shkunov, D. Sparrowe, S. Tierney, R. Wagner, W. Zhang, M.L. Chabinyc, R.J. Kline, M.D. McGehee, M.F. Toney, Nature Materials, 5 (2006) 328.

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Enhanced Hole Mobility in Regioregular Polythiophene Infiltrated in Straight Nanopores, K.M. Coakley, B.S. Srinivasan, J.M. Ziebarth, C. Goh, Y. Liu, M.D. McGehee, Advanced Functional Materials, 15 (2005) 1927.

Molecular Weight Dependent Mobilities in Regioregular Poly(3-hexylthiophene) Diodes, C. Goh, R.J. Kline, M.D. McGehee, E.N. Kadnikova, J. Liu, J.M.J. Fréchet, Applied Physics Letters, 86 (2005) 122110.

The Dependence of Regioregular Poly(3-hexylthiophene) Film Morphology and Field Effect Mobility on Molecular Weight, R.J. Kline, M.D. McGehee, E.N. Kadnikova, J. Liu, J.M.J. Fréchet, M.F. Toney, Macromolecules, 38 (2005)3312.

Controlling the Field-Effect Mobility of Regioregular Polythiophene through Molecular Weight, R.J. Kline, M.D. McGehee, E.N. Kadnikova, J. Liu, J.M.J. Frechet, Advanced Materials, 15 (2003) 1519.

Light extraction from LEDs

A Theoretical and Experimental Investigation of Light Extraction from Polymer Light-emitting Diodes, J. M. Ziebarth and M. D. McGehee, Journal of Applied Physics, 97 (2005) 064502.

Measuring the Refractive Indices of Conjugated Polymer Films with Bragg Grating Outcouplers, J. M. Ziebarth, M.D. McGehee, Applied Physics Letters 83, (2003) 5092.

Extracting Light from Polymer Light-Emitting Diodes with Stamped Bragg Gratings, J.M. Ziebarth, A.K. Saafir, M.D. McGehee, S. Fan, Advanced Functional Materials, 14 (2004) 451.

Lasers and LEDs

Semiconducting (Conjugated) Polymers as Materials for Solid-State Lasers (Review Article), M.D. McGehee and A. J. Heeger, Advanced Materials, 12 (2000) 1655.

Mirrorless Lasing from Mesostructured Waveguides Patterned by Soft Lithography, P. Yang, G. Wirnsberger, H.C. Huang, S.R. Cordero, M.D. McGehee, B. Scott, T. Deng, G.M. Whitesides, B.F. Chmelka, S.K. Buratto, G.D. Stucky, Science, 287 (2000) 465.

Narrow Bandwidth Luminescence from Blends with Energy Transfer from Semiconducting Conjugated Polymers to Europium Complexes, M.D. McGehee, T. Bergstedt, A.P. Saab, C. Zhang, M. O'Regan, G. Bazan, V. Srdanov, A.J. Heeger, Advanced Materials, 11 (1999) 1349.

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Professor McGehee's primary interests and areas of expertise are organic electronics, patterning materials at the nanometer length scale and developing materials for renewable energy and sustainability applications. His research group's projects are briefly described here and thoroughly described in our publications, which are listed elsewhere on this website.

Physics of Nanostructured Solar Cells

Frequently the performance of polymer solar cells is optimized by a trial and error approach. While we recognize the effectiveness of this approach, we believe that it is critical to have a deep understanding of how cells work in order to fully optimize them and approach the theoretical efficiency limits. We perform simulations and experiments to understand all of the critical processes that occur in polymer solar cells. We start by measuring the refractive indices of every layer in the cells and calculating where the light is absorbed in order to figure out where the excitons are created. We collaborate with Peter Peumans, Shanhui Fan and Mark Brongersma to develop novel methods for enhancing absorption in thin films. We model exciton diffusion and energy transfer to determine what fraction of the excitons reach a donor-acceptor interface. In collaboration with Jean Frechet, we have shown that long-range resonant energy transfer can be used to substantially improve exciton harvesting. We use time-resolved spectroscopy to study forward and back electron transfer. Jean Luc Bredas (Georgia Tech) performs quantum chemical calculations that help us interpret the results. Stacey Bent helps us to systematically modify the properties of the donor-acceptor interfaces and determine how those properties affect the rate of electron transfer. We use a variety of transport measurements to determine charge carrier mobilities. Finally, we create device models and compare the predictions to measured values. We are developing novel methods for enhancing the performance of the solar cells and will report on them as soon as our publications appear.

Dye Sensitized Solar Cells and Organic-Inorganic Hybrid Solar Cells

We make well ordered nanostructured solar cells by using self-assembly and nanoimprinting to make nanoporous titania films with straight pores and then filling those pores with semiconducting polymers. We have demonstrated that it is easy to extract the charge from the solar cells, but have had difficulty making the polymer domains small enough for all of the excitons to reach the polymer-titania interface. Efforts are underway to use energy transfer to enhance exciton harvesting and to make nanostructures with smaller features. We have recently started to collaborate with Michael Graetzel (EPFL) on some new approaches for making dye sensitized solar cells.

Structure-Property Relationships in Semiconducting Polymers

We use techniques such as x-ray diffraction, spectroscopy, and atomic force microscopy to determine how molecules pack in polymer solar cells and how the packing affects properties such as exciton diffusion, electron transfer and charge transport. Several years ago we discovered that the molecular weight of a polymer is one of the most important factors that determines its charge carrier mobility. We showed that the size of the molecules affects the rate at which crystals form and that this determines whether crystals nucleate off the substrate or in the bulk of the film. When crystals nucleate off the substrate, they tend to be well aligned. Consequently the insulating sidechains do not impede charge transport between neighboring crystals. In 2008 we discovered that one of the most important properties of a semiconducting polymer for photovoltaic applications is the amount of space that is available between the sidechains. We found that the fullerene derivatives that are commonly used to make bulk heterojunction solar cells can often intercalate between the sidechains. When this happens, exciton splitting is extremely efficient because the polymer and fullerene are not phase separated. On the other hand, we believe that recombination is faster since the polymer and fullerene are mixed at the molecular scale. We find that when intercalation occurs, one must use substantially more fullerene to optimize the performance of the blend because one needs enough fullerene to fill in the spaces between the polymer sidechains and create a pure fullerene phase that can carry electrons out of the solar cell.

Our x-ray diffraction measurements are performed in collaboration with Michael Toney (SSRL). The molecules we investigate are usually made by the research groups of Jean Frechet (Berkeley), Zhenan Bao (Stanford), Alan Sellinger (Stanford), Iain McCulloch (Imperial), and Martin Heeney (Queen Mary).

Carbon Nanotube Networks as Transparent Electrodes

We have demonstrated that it is possible to make extremely flexible transparent electrodes with networks of carbon nanotubes and use them to replace brittle ITO in polymer solar cells. The conductivity of these films is approximately 10 times less than that of ITO. We are trying to understand what limits the performance of the films so that we can enable our collaborators (George Gruner, Zhenan Bao) to increase the conductivity. Back-of-the-envelope calculations show that it should be possible to make films that are approximately 10 times better than ITO. Our investigation involves using

electric force microscopy to create maps of the resistance in films and computer simulations to determine what the conductivity should be as a function of how many tubes there are, how long the tubes are, what the conductivity of the tubes is, what the junction resistance is, and whether the tubes are metallic or semiconducting.

Polymer Solar Cell Reliability

In Fall of 2008, we are just starting a new program to determine how long polymer solar cells last and what limits their lifetime. We will be performing electrical tests on the cells before and after long-term operation. We will collaborate with Reiner Dauskardt to study mechanical failure of the devices.

June 11, 2009

CURRICULUM VITAE

David Chandler

Personal Information:

Date of Birth: October 15, 1944
Place of Birth: Brooklyn, New York
Married, 2 children, 2 grandchildren

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University of California, Berkeley
Berkeley, California 94720 USA
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URL: http://gold.cchem.berkeley.edu/

Education:

B.S., Massachusetts Institute of Technology, 1966
Ph.D., Harvard University, 1969

Research Interests:

Theoretical chemistry and statistical mechanics. Applications to structure, dynamics and phase transitions of simple and complex systems.

Professional Appointments:

Chemistry Teaching Fellow, Harvard, 1966-1969.
Postdoctoral Research Chemistry, University of California, San Diego, 1969-1970.
Assistant (1970-1975) to Associate (1975-1977) to Full (1978-1983) Professor of Chemistry, University of Illinois, 1970-1975.
Visiting Associate Professor of Chemistry, Columbia University, 1977-1978.
Visiting Scientist (Consultant), I.B.M. Research Center, Yorktown Heights, NY 1978.
Visiting Scientist (Consultant), Oak Ridge National Laboratory, 1979.
Professor of Chemistry, University of Pennsylvania, 1983-1985.
Professor of Chemistry, University of California, Berkeley, 1986-present.
Consultant, Los Alamos National Laboratory, 1987-1990.
Directeur de Recherche, Laboratoire de Physique, Ecole Normale Superieure, Lyon, France, Fall 1992.
Faculty Chemist, Lawrence Berkeley National Laboratory, 1996-present.
Schlumberger Visiting Professor, Oxford University, 2003, 2004.
Bruce H. Mahan Professorship, University of California, Berkeley, 2004- present
Member of Executive Board (2001-2008) and Executive Director (2006-2008) Miller Institute for Basic Research in Science

Awards and Honorary Lectures

Alfred P. Sloan Research Fellow, 1972-74.
Associate in the Center for Advanced Study, University of Illinois, 1974.
Elected Fellow of American Association for the Advancement of Science, 1980.
Elected Fellow of American Physical Society, 1982.
Guggenheim Fellowship, 1981-82.
Bourke Medal and Lectureship, Royal Society of Chemistry, 1985

Joel Henry Hildebrand Award in the Theoretical and Experimental Chemistry of Liquids, American Chemical Society, 1989
Flygare Memorial Lecturer, University of Illinois, Urbana, Illinois, 1989
Miller Institute Research Professor, 1991 (Fall), 1999-2000 (Academic Year)
Hinshelwood Lecturer, University of Oxford, 1993
Christensen Visiting Fellow, St. Catherine's College, University of Oxford, 1993.
Kolthoff Lectureship in Chemistry, University of Minnesota, 1994
Elected Fellow of American Academy of Arts and Sciences, 1995
Elected Member of National Academy of Sciences, 1995
Theoretical Chemistry Award, American Chemical Society, 1996
Journal of Physical Chemistry Centennial Lecturer, 1996
Hirschfelder Theoretical Chemistry Prize, University of Wisconsin, 1998
Washburn Memorial Lecture, University of Nebraska-Lincoln, 1999
Merck Frosst Lecture, University of British Columbia, 1999
Alexander von Humboldt Foundation Research Award, 1999
Mulliken Medal and Lecturer, The University of Chicago, 2000
Visiting Fellow, Merton College, University of Oxford, 2001
Lennard-Jones Lecturer, Royal Society of Chemistry, 2001
Distinguished Colloquium Series, University of British Columbia, 2002
Kaufman Lecturer, Univesity of Pittsburgh, 2003
Laughlin Lecturer, Cornell University, 2004
Cherry Emerson Lecturer, Georgia Institute of Technology, 2004
Palke Lecturer, University of California, Santa Barbara, 2004
Irving Langmuir Award in Chemical Physics, American Physical Society, 2005
G.B. Kistiakowsky Lecturer, Harvard University, 2006.
Visiting Overseas Scholar, St. John's College, University of Cambridge, 2008

Professional Activities

Publications: Two books and over 200 refereed publications. Complete bibliography posted at **http://gold.cchem.berkeley.edu/bibliography.html**

Research Grants: Continuous funding since 1971 from Federal and private agencies. Lists of grants available on request

Journal Editorship and National Committees: Service for various editorial boards and professional societies, currently serving as Associate Editor of the *Proceedings of the National Academy of Sciences, USA*. Lists available on request.

Professional Lectures and Meetings: Over 250 invited lectures delivered throughout the world at universities, national laboratories and professional meetings. Several conferences organized including two Gordon Research Conferences, and every year since year 2000 the annual Berkeley "Mini Statistical Mechanics Meeting." Lists available on request.

Further information found at **http://gold.cchem.berkeley.edu**